CTCN Technical Assistance

Response Plan

Country:	Sudan
Request Identification Number:	AF-2021000101

Title:	*Strengthening the community-based Flood and drought preparedness and early warning system in Sudan using operational and innovative models in addition to Satellite-based transmission technology for real-time automatic water level telemetry system* *[Scope: Updating and improving existing hydrologic and hydraulic models and configuring a Flood Early Warning System (FEWS) in Sudan]*

Summary of the CTCN Technical Assistance

Provide a summary in line with the corresponding request for the CTCN assistance to be used for external communication purposes.

Climate change presents additional stress for Sudanese people already struggling with poverty, post-conflict recovery, and environmental degradation. It has exacerbated Sudan's social and economic challenges with the increasing occurrence of floods and droughts due to the growing inter-annual variability of precipitation in the Nile basin. These effects can already be seen today and have a massive impact on the water-food-energy-nexus. Extreme events have led to widespread property loss, damage to irrigation facilities and water services, and the spread of waterborne diseases.

The population in the Nile River system is estimated at 31 million. Although the population at risk of floodis unknown, many of major cities of Sudan (e.g., Khartoum, Wad Madeni, Singa, Rabak, and Ad Damar) are located along the mainstream or tributaries of the Nile, and the combined population of these cities alone amounts to morethan 10 million, many of which suffered severely from the flood disasters in the last decades.

During the recent flood in 2020 the Nile reached its highest water level in 100 years, by more than 60 centimetres, and inflicted devastating damage to Sudan. The flood began in mid-July and marked the country's worst eventin 30 years. According to the National Council for Civil Defence in Sudan, at least 121 people died, 54 were wounded, more than 98,000 houses collapsed, and more than 97,000 agricultural acres and numerous livestock were lost. Moreover, many buildings and facilities were adversely affected.

This Response Plan was prepared to correspond to the technical assistance request submitted by the Nile Water Department, Ministry of Irrigation and Water Resources of Sudan. The requested technical assistance focused on strengthening the capacities for flood and drought preparedness and early warning system in Sudan using operational and innovative models. In mutual discussions with the CTCN, national proponent and the NDE, it was agreed to focus the scope of the requested technical assistance on flood early warning and preparedness specifically.The requested technical assistance has been subjected to a scope reduction shifting from a broad range of intervention (flash floods, drought, installation of telemetric monitoring stations, amongst other aspects) to the enhancement of an existing flood early warning system and corresponding modelling framework.

The proposed technical assistance will enhance the existing Flood Early Warning System (FEWS) setup by the Nile River basin regional entity the Eastern Nile Technical Regional Office (ENTRO) – comprising Egypt, Ethiopia, South Sudan, and Sudan – so that it is appropriate for Sudanese authorities' flood management operations in Sudanese national sub-basins.

The key outcome of this technical assistance will be Sudan being enabled to operate an innovative

adaptation technology such as a FEWS to increase the resilience of communities, infrastructure, and economic sector investments in flood affected areas. The enhancements to the existing technology will include an early warning component that will allow better preparation and increased response capacity by authorities and communities for upcoming floods, minimizing losses and damages.

1. Overview of the CTCN technical assistance

1.1 Technology aspects

Sudan wantsto strengthen the technological and technical capacity of the Ministry of Irrigation and Water Resources(MoIWR)national staff. Part of this effort is the use ofa Flood Early Warning System(FEWS) and linking the system with the stakeholders concerned and communities in flood-prone areas.

The technical assistance will provideinformation needed for effective dissemination of flood warnings, by providing the Nile Water Department under MoIWR, the applicant, with the required technological enhancements and capacity building of staff as a measure to adapt and reduce risk of flooding in Sudan.

This will be achieved by further developing the existing FEWS that Sudan has access to, hosted by the Eastern Nile Technical Regional Office (ENTRO), andby training the Sudanese FEWS operators.

The ENTRO FFEWS is based on MIKE OPERATIONS technology (a DSS software framework developed by DHI[1]). It covers the Blue Nile, Sobat and Atbara River basins. The coverage of the Dinder and Rahad sub-basins is limited to rainfall and runoff forecasts. It is operational yet the coverage and quality of the models needs to be improved according to the Nile Water Department.

The components of the ENTRO FEWS are the following:

- Meteorological Forecasts – Weather Research and Forecasting model
- Hydrological Forecasts – NAM model
- Flood Forecasts – MIKE 11 model
- Integrated Forecast System – MIKE OPERATIONS platform

The model is not fully operational for use by Sudan, needs to be updated with respect to land use changes, and the Dinder&Rahad basins are only covered hydrologically. In addition, the dissemination and reporting method is not operational, impeding efficient use of the model information to inform decisions and response relating to the flood and drought hazards.

The technical assistance will develop the existing FEWS technology by providing the following updates/expansions:

- Review and improve the existing model with regards to newly available data such as land use change and expand the modelling framework to cover the Dinder and Rahad basins.
- Validate the Weather Research and Forecasting (WRF)model from ENTRO, review and improve the overall performance of the FEWS.
- Develop the dissemination component following the requirements of the Nile Water Department and the stakeholder consultation process.

1.2 Objectives (outcomes)

Theobjectives are to, in very close collaboration with the Nile Water Department and selected national beneficiaries and stakeholders:

- Assess the existing Flood Early Warning System of ENTRO available to Sudan, current protocols/procedures and institutional framework.

[1]*For more information, please go to*MIKE OPERATIONS (mikepoweredbydhi.com)

- Expand and enhance the components of the FEWS, based on readily available data for increased coverage, efficiency and lead time in the Setit/Atbara, Dinder and Rahad national sub-basins.
- Train system operators and build the capacity of a wider net of national FEWS product end users to maximize benefits for the country's disaster management framework.
- Host the system for a period of 2 years to create a time window for the Ministry to purchase and install their own hardware, so that the system can be transferred to their premises.

1.3 Results (outputs expected from CTCN assistance)

According to the objectives of the technical assistance the outputs will be as follows:

- **Output 1. Assessment of the existing FEWS system protocols and data identifying existing gaps and needs.** Consultative meetings for understanding existing relevant protocols/processes and data collection will be carried out and a multi-stakeholder inception workshop to understand the expectations of the stakeholders, identify the needs, gaps, guidelines, and lessons learned from completed and ongoing projects to collect/generate and provide similar data/systems. Data will be reviewed, and gaps identified. System operators will be identified, and their capacity assessed to inform the training sessions required to enable the identified staff to operate the enhanced FEWS. The FEWS will be reviewed, and the technical improvements proposed captured in a design report.
- **Output 2. Enhanced FEWS.**Based on the needs assessment the technical team will develop the changes to each of the FEWS components, namely the weather, hydrological, hydraulic forecasting and dissemination components.
- **Output 3. Strengthened capacity and sustainability for uptake and effective use of the upgraded FEWS.**The existing technical manuals will be updated in accordance with system alterations carried out. Based on the capacity needs assessment the identified staff will be trained remotely and in person. In addition, a broader range of selected relevant stakeholders will be trained in the application of the FEWS end products as determined by the Nile Water Department. Post-technical assistance the system will be hosted by DHI for a period of 2 years to allow for Sudan to have enough time to mobilize national or other sources of funding to purchase and install hardware. After this, the system would be transferred to Sudan with DHI's assistance.

1.4 Expected use of outputs

Like most developing countries, Sudan is yet to fully take advantage of advanced and innovative technologies due to technical, financial, and economic reasons and barriers. The institutional and individual capacity at the national and state levels continues to be quite limited and will need sustained strengthening to realize the benefits from technical support projects.Inadequate funding both at the national and international levels threatens to limit the implementation of climate change adaptation measures identified in Sudan's NAPA.

This technical assistance builds on the existing regional institutional and technological frameworks by expanding current climate technology, the ENTRO FEWS, to respond to the needs of the Sudanese authorities and increasing the Sudanese capacity to the required level to efficiently operate it. To allow the country to continue advancing, a wider net of stakeholders will be actively engaged,and their capacity built to enable their use of the system's products. In addition, the system will be run at DHI's servers supported by its IT infrastructure for the period of 2 years to allow the Ministry to purchase the hardware needed to be able to host the system at its own premises.

The expected outputs from the CTCN assistance will contribute to Sudan's capacity to advance and implement climate technologies in following ways:

Output 1. Assessment of the existing FEWS system protocols and data identifying existing gaps and needs. The assessment will help establish understanding of the current system capabilities and to increase understanding as to what extent the FEWS is able respond to the current country needs and where are the most pressing gaps. The findings will also incorporate stakeholder feedback on what aspects of the current system need upgrading to be able to perform adequately and provide best possible decision support to respond to climate hazards.

Output 2. Enhanced FEWS. The upgraded system will enable uptake of the latest technologies and data and will also support expansion of the system coverage to include additional sub-basins currently not covered by FEWS. In this way, the enhanced FEWS will improve the capability of the decision makers and relevant national institutions to effectively and timely use the system for better flood early warning and response.

Output 3. Strengthened capacity and sustainability for uptake and effective use of the upgraded FEWS. By strengthening the capacity for system use and maintenance, and a 2-year period for Sudan to put in place and prepare its own IT infrastructure, the output will contribute to long-term sustainability of the system, enabling more effective long-term and strategic use of the relevant technologies.

2. Description of the Assistance

2.1 Activities

Activity 1 Stakeholder consultation, assessment of available data and existing FEWS

Activity 1.1 – Project initiation and kick-off meeting
In this activity the implementer will hold a remote kick-off meeting and formally initiate the Technical Assistance (TA), establish staff relations and communication lines at required levels. Map all relevant stakeholders that need to be involved. Evaluate risks and map these jointly with the Nile Water Department.

In addition, the technical assistance management documentation, namely, Detailed work plan, Monitoring & evaluation (M&E) plan and impact statement will be prepared as required by the TA implementation guidelines.

The result of this activity will be documented in Activity 1.3's written deliverable, the Inception Report.

Deliverables	**Delivery date**
Kick-off meeting	*Month 1*

Activity 1.2 – Data collection and stakeholder consultation
Consultative meetings with the Nile Water Department will be held to understand in depth the current processes/protocols for the generation, provision, management and sharing arrangements of data as well as current approach to FEWS. This is crucial so that only technology and operational practice is supplanted and does not impose restrictions on to the existing institutional framework.

It is assumed that the Sudan Nile Water Department can have access to ENTRO's forecast models and all required software licenses through the provisions of collaboration between Sudan and ENTRO. Table 1 lists examples of data types required for the establishment of a FEWS. An assessment will be

made on the availability of the data listed. An initial pre-assessment is also included in Table 1 and will be further elaborated and validated together with stakeholders.

Table 1 Required data for Technical Assistance

Data type	Accuracy	Specifications
TIME SERIES (Excel columns of date-time and value. Missing data as blanks)		
Rainfall at stations	Daily	
Satellite rainfall time series	Daily	CHIRPS and/or similar
Potential evaporation	Daily or monthly	
Water level	Hourly or daily	
Discharge	Hourly or daily	
Data at real-time reporting stations	Hourly or more frequent	All historical data available
Quantitative precipitation forecasts	As available	Historical QPFs of heavy rainfall events if available
Water use	Daily	Including information on abstraction points and return flow
Reservoir water level	Daily	
Reservoir releases and estimated evaporation	Daily	
Estimated reservoir inflow if available	Daily	
Hydropower production	Hourly or daily	
PHYSICAL DATA (Excel or text files)		
River cross sections	Every 5 km or closer	Covering all possible water levels along the river, where flood forecasting is planned
Rating curves and associated discharge measurements		Including background data on validity etc.
Structure dimensions		Reservoirs, weir, bridges etc.
Operational rules for reservoirs		
GIS (shapefiles, raster)		
Rainfall stations		point layer
River stations		point layer
Reservoirs		point layer
Digital elevation model	30mor better	Hydrologically corrected if available
Land use		

The list of FEWS product end users for flood alerts will be updated by collecting information on vulnerable communities in flood-prone areas in Sudan. Sources of such information are expected to be in addition to the Nile Water Department itself, the national and local authorities, international development and aid organizations and non-governmental organizations operating in those areas. This will ensure that continued preparedness and early warning measures communication and dissemination are easily accessible to rural communities.

Based on the stakeholder mapping, consultative meetings will be held with the different organizations to inform and understand expectations about the TA and for collection of data and information from those stakeholders.

The result of this activity will be documented in Activity 1.3's written deliverable, the Inception Report.

Activity 1.3 – Inception workshop
A multi-stakeholder inception workshop will be held to understand the expectations, identify the needs, gaps, guidelines, and results and lessons learned from completed and ongoing projects to collect/generate and provide similar data/systems. The workshop will be chaired and organized by the Nile Water Department with support by the TA implementer. It is envisioned that it will be up to1 day workshop in Khartoum with a maximum of 25 participants.

Deliverables	**Delivery date**
Inception workshop	*Month 1*
Inception report	*Month 2*
Technical assistance management documentation	*Month 2*

Activity 1.4 – Review of the collected data
The MoIWR is making a great effort to manage the floods by expanding and upgrading the ordinary hydrometric water level stations to automatic water level stations with fully real-time and remote transmission (telemetry system). It is assumed real-time data will be available to the TA implementer as it is not part of the TA the delivery of any monitoring equipment or new observed data.

Assuming the required data in Table 1 is available and shared with the TA team, the collected data will be reviewed for quality and gaps. Additional data collected during the stakeholder consultation activity will also be processed and reviewed.

It is recognised that these are transboundary basins and not all data is available at the national level. Depending on the agreements / data sharing protocols that are in place some of the required data may not be available. The TA Implementer will advise the Nile Water Department of the repercussions the missing data will have on the following activities and the FEWS and possible mitigation measures.

Repercussions would impact the design of the enhanced system itself (including modelling framework) and ultimately operations and performance. Hydrometry (real-time and historical) time series for calibration/validation and data assimilation will be used to carry out activities relative to Output 3. Similarly, river cross-sections will be the basis for expanding the hydraulic model for the additional river reaches.

The result of this activity will be documented in Activity 1.4's written deliverable.

Activity 1.5 – Model and FEWS review
The hydrologic and hydraulic components of the existing FEWS modelling framework will be revised and the performance assessed. The forecasting and disseminationcomponentswillalso be reviewed, and the technical improvements captured in anenhanced FEWS design report. The report will be presented to the client in Activity 1.6's meeting.

Deliverables	**Delivery date**
Enhanced FEWS design report	*Month 3*

Activity 1.6 – Capacity needs assessment
System operators will be identified, and their capacity assessed to inform the training sessions required to enable the identified staff to operate the enhanced FEWS. The results will be captured in a capacity needs assessment brief note containing the proposed training programme.

A meeting in person will take place to inform the capacity needs assessment as well as to present the deliverables of the previous activities 1.4 and 1.5 , the Enhanced FEWS design report.

Deliverables	**Delivery date**
In person meeting	*Month 4*
Capacity needs assessment note	*Month 4*

Activity2 – Enhancement of the FEWS

Activity 2.1– Expansion and improvement of the FEWS components
Based on the needs assessment the technical team will develop the changes to each of the FEWS components, namely the weather, hydrological, hydraulic forecasting and dissemination components.
A weather forecasting system will be added to the FEWS. This translates into selecting the most suitable source for rainfall forecasts – provided access by ENTRO is given to Sudan Nile Water Department – WRF would be applied and carrying out the configuration of the system with the required automated processes.

The hydrological and hydraulic modelling framework will be improved as established in the design report. It is expected this may include for the hydrological component:

- Land use changes have occurred since the model was established and the model parameters will be dully altered to represent these changes.
- Improvement of the model to cover the Setit/Atbara basin and Dinder&Rahad basins

For the hydraulic component:

- Updates will be carried out based on recent topographic and structural information, where available
- Expansion of the model to cover the Setit/Atbara and the Dinder&Rahad rivers

This work will be followed by the calibration and validation with the historical time series collected, and implementation of a data assimilation procedure depending on real time data available and collected (Table 1).

The enhanced hydrologic and flood forecasting system will be integrated into the FEWS. This involves extensive reconfiguration efforts of the information flows in and out of the models. A dissemination system will be designed together with the Nile Water Department and relevant stakeholders, and its implementation and configuration carried out by the TA team.

The system will be hosted at DHI's servers for a period of 2 years to create a time window for the Ministry to purchase and install their own hardware, so that the system can be transferred to their premises, the transfer will be done with DHI's assistance. Therefore, the assumption that the Ministry has access to ENTRO software licenses is key as a new installation at DHI's servers will need to be made.

Deliverables	**Delivery date**

Model calibration and validation report	*Month 6*

Activity 2.2– Review and improvement of the overall performance of the system
The forecast model must show that it is simulating the historical conditions (in terms of flow and water levels) with accepted accuracy and computational efficiency. This mainly focuses on the model evaluation by comparison of historical observations and forecastswith simulated data series at various locations. In assessing the forecasting performance, goodness-of-fit measures are presented as the average magnitude of the errors as a function of lead time over the evaluation period for select key locations. Improvement of the system performance will depend highly on the quality of the time series data in Table 1.

During a period of 9 months, the trained operators will run the FEWS system and report on any issues and difficulties observed. It is anticipated that a dedicated communication process during this period with the TA implementer may be established e.g. through the initiation of interactive emailing on a regular basis (twice a month).

The TA implementer will provide the Nile Water Department with recommendations of what actions should be prioritized targeting the future improvement of system performance specifically.

Deliverables	**Delivery date**
Enhanced FEWS operationalized	*Month 7*

Activity 2.3– Technical manual update
The existing technical manual will be updated in accordance with system alterations carried out.

Deliverables	**Delivery date**
Updated technical manual	*Month 7*

Activity3– Capacity building for use of the enhanced FEWS

Activity 3.1 – Production of training materials
The CTCN TA implementer will produce materials for the online and face-to-face training sessions of system operators as well as for the stakeholder workshop for FEWS product end users.

Deliverables	**Delivery date**
Training materials	*Month 8*

Activity 3.2 – Training of government bodies and stakeholders for use of the system
The selected system operators will receive training in the usage and operation of the system. The proposed format is a face-to-face 5-day training session for a maximum of 12 participants, assuming active involvement of the designated staff on use of the forecasting system. Online ad-hoc assistance via email will be available for the duration of Activity 3.

Deliverables	**Delivery date**

In person training session and remote support	*Month 8, and during Month 9 to 16*

Activity 3.3 – Stakeholder workshop for FEWS product end users
A broader range of selected relevant stakeholders, from those already identified during the activities of Outputs 1 and 2, will be trained in the application of the FEWS products as determined by the Nile Water Department. This will be done via a 1-day workshop for a maximum of 25 participants, these may be the same as the inception workshop participants.Active involvement of the proponent is expected in the organization of the workshop in support of the project manager similarly to the Inception workshop (for example chairing, sending official invitations and contributing to the agenda).

At the end of Activity 3 an encompassing Capacity enhancement report will be produced, describing the outcomes of the technical training and the end user workshop as well as participants feedback and evaluation.

Deliverables	**Delivery date**
FEWS product end user workshop	*Months 17*
Capacity enhancement report	*Month 17*

Activity 3.4 – Preparation of the closure report
As required by the CTCN TA implementation guidelines, the technical assistance closure report will be prepared and submitted.

A period of 2-years maintenance is included to cover costs of keeping the system online at DHI's infrastructure, plus time up to a day for assistance by IT expert to install the system at Sudan's premises, once the country has purchased and installed their own hardware and supporting IT infrastructure during that period.

Deliverables	**Delivery date**
Technical assistance management documentation	*Month 18*
2-years of maintenance of the final system using DHI's infrastructure and transfer of the system	*Post-project*

2.2 Synergies and Baseline Setting

Following the floods of 1988, the Sudanese Ministry of Irrigation and Water Resources (MoIWR) in Sudan initiated an operational flood forecasting system to allow flood warnings to be provided with sufficient lead time. This system was developed with technical assistance from the Netherlands and became operational in 1992. Known as FEWS Sudan (Flood Early Warning System), this system was operated successfully from 1992 to 1995. Following 1995, there were problems with the obtaining of remotely sensed rainfall data. Since then, alternative sources of rainfall data have been found, and the system has been used in several flood seasons since then, though the quality of the forecasts has diminished.

Additionally, there were some difficulties in maintaining a suitably trained team to sustain the system's operation, although currently, the system, when operated, is done so by the Ministry's self-trained staff. The system installed in 1992 was based on the original version of Delft FEWS from 1992 (developed by Delft Hydraulics, now Deltares), which is now quite outdated. Since then, the

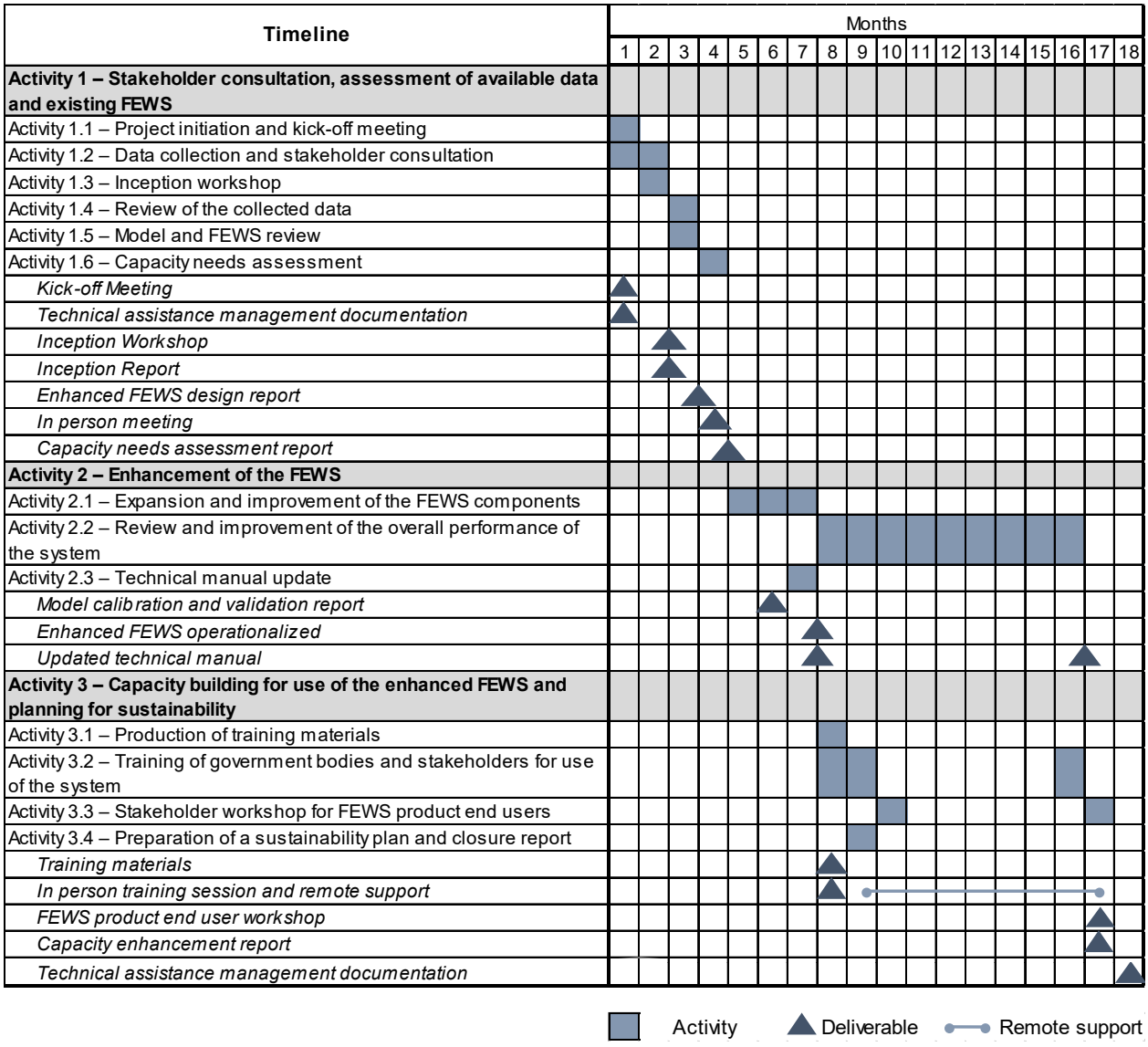
Delft FEWS system has advanced considerably and now uses the latest available technology in integrating data and models in a forecasting environment.

In 2010, Sudan-FEWS was upgraded into a new version and operating since then in ENTRO-Ethiopia, and it is only working for the Blue Nile Basin. Hence the application for this technical assistance. This is the system that this TA will expand based on readily available data.

ENTRO's Eastern Nile Flood Forecast Early Warning System (EN-FFEWS) is an integrated real-time forecasting and early warning system that supports ENTRO, as well as regional and national stakeholders in flood forecasting and early warning. Thelatest version of thisenhanced system is operational and running.One component of the EN-FFEWS is a customized version for the EN of the Weather Research and Forecasting (WRF) model. The other component builds upon DHI's decision support system, MIKE Operations with integrated modelling tools to simulate hydrological and hydrodynamic processes.

In addition, the expansion and enhancement of the existing FEWS is aligned with the Intended Nationally Determined Contribution (INDCs) (2015), the Technology Needs Assessment- Adaptation (TNA) (2013) and the National Adaptation Plan (NAP) (2016) with regards to Sudan's need to implement operational forecasting systems as adaptation measures to flooding and the impacts of climate change.

2.3 Timeline



2.4 Expertise required

Activity 1	
Expert 1: Project Manager and Flood Expert, 21person/days, International	*Overall responsible for team management and coordination, operational deliverables and written deliverables. Project coordination and management including being the point of contact to the client. Key responsible for capacity building activities.*
Expert 2: Hydrologist and Flood ModellingExpert, 9person/days, International	*Participation in the kickoff meeting and support during the development of the inception report and preparation of inception workshop with focus on existing data and current FEWS.* *Support during the development of the FEWS design report and capacity needs assessment report. Review the latest available hydrometric and hydro-meteorological ground data.*
Expert 3: Flood Forecasting and Operational Systems Expert, 9person/days,	*Responsible for the development of enhanced FEWS design report. Review of existing data and investigate the latest available data taking into consideration reliability and long-term availability.*

International	
Expert 4: Gender Expert, 4person/days National/Regional	*Review of workshop material from a gender sensitivity perspective. Participation in Event 2 to support with gender sensitivity and reporting on gender-based participation.*
Event 1: Kick-off meeting	*Establishment of communication lines and initiation of the technical assistance. Understanding expectations and current processes and protocols in place. Assessment of available data.*
Event 2: Inception Workshop	*A multi-stakeholder inception workshop will be held to understand the expectations, identify the needs, gaps, guidelines, and results and lessons learned from completed and ongoing projects. The 1-day workshop will be held in person and will be facilitated by Expert 1 and Expert 4. About 25 local stakeholders are expected to take part in the workshop.*
Event 3: In person meeting	*An in-person meeting will be held to inform the capacity needs assessment as well as to present the deliverables of activities 1.4 and 1.5, the Enhanced FEWS design report.*
Activity2	
Expert 1: Project Manager and Flood Expert, 6person/days, International	*Overall responsible for team management and coordination, operational deliverables and written deliverables. Project coordination and management including being the point of contact to the client. Key responsible for capacity building activities.*
Expert 2: Hydrologist and Flood ModellingExpert, 24person/days, International	*Carry out the hydrological (Rainfall-Runoff) modelling as part of enhancement of FEWS and coordination of modelling activities. Responsible for calibration and validation report, including hydraulic modelling and coordination of modelling activities.*
Expert 3: Flood Forecasting and Operational Systems Expert, 24person/days, International	*Responsible for the configuration of the enhancements,improvement of performance, and operationalization of the enhanced FEWS.*
Activity3	
Expert 1: Project Manager and Flood Expert, 18.5person/days, International	*Key responsible for capacity building activities. Support the proponent with organization of the training and stakeholder workshop. Participation in Events 3 and 4.*
Expert 2: Hydrologist and Flood ModellingExpert, 9person/days, International	*Support the development of capacity building material and participation in online training sessions. Participation in a 5-day in person training (Event 3).*
Expert 3: Flood Forecasting and Operational Systems Expert, 9person/days, International	*Support the development of capacity building material and participation in providing remote support to system operators during the 9-month period when performance is reviewed.Participation in a 5-day in person training (Event 3).*

Expert 4: Gender Expert, 5person/days National/Regional	*Review of capacity building material from a gender sensitivity perspective. Participation in a 5-day in person training (Event 3).*
Event 3: In person training	*This 5-day in person training event will focus on operation and maintenance of the enhanced FEWS and will be conducted in support to online training sessions. It will be facilitated byExpert 1, Expert 2, and Expert 3. Expert 4 attends to support with gender sensitivity and reporting on gender-based participation. Approximately 12 local system operators are expected to take part in the training.*
Event 4: FEWS product and user workshop	*A 1-day workshop dedicated to the introduction and usage of FEWS. It will be held in person and will be facilitated by Expert 1, with active support by the Proponent. About 25 local stakeholders are expected to take part in the workshop, most likely the same as the attendees to the Inception workshop.*

2.5 Main partners

Stakeholder	**Role to support the implementation of the CTCN assistance**
Higher Council for Environment and Natural Resources *Climate Change Directorate* *CTCN NDE*	• Responsible for endorsement of the application acts national focal points to the Adaptation Fund Facilitator. • Coordinate the process of the call organization and finalization
Nile Water Department *Ministry of Irrigation and Water Resources* *CTCN Applicant*	• Providing national data to the CTCN implementer • Make the existing models and FEWS available to the CTCN implementer • Identification and engagement of all relevant authorities and of the required local/national/international partners to maximize the benefits. • Collaborate closely with the CTCN implementer in the enhancement of the existing FEWS, namely with respect to the development of the forecasting components as well as warningdissemination component. With respect to flood warnings, effective delivery of relevant information in a form readily understood by and useful to intended users, from government agencies to floodplain dwellers, is essential. Therefore, the CTCN implementer will require active engagement and involvement. • Chair workshops, invite attendees and help CTCN implementer in the organization of events • Supply staff to become the operational administrators and users of the enhance FEWS. • Results and lessons learned from completed or

	ongoing projects producing similar outputs
Department of Meteorology and Hydrology (DMH)	• Consultation about forecast data available for the FEWS • Results and lessons learned from completed or ongoing projects producing similar outputs
Eastern Nile Technical Regional Office (ENTRO)	• ENTRO, the Eastern Nile Technical Regional Office, headquartered in Addis Ababa, Ethiopia, is the executive arm of the Eastern Nile Subsidiary Action Program (ENSAP) – comprising Egypt, Ethiopia and Sudan. • Supports in preparing cooperative water resources investment programs and projects, capacitating and strengthening institutions and providing secretariat support to its governance. • Hosts the Flood Early Warning System (FEWS) that will be enhanced in this TA for Sudan.
National Council for Civil Defense	• Source of data and information on flood events and particularly flood affected communities
International Development and Aid Organizations *Non-governmental Organizations*	• Source of data and information on flood events and particularly flood affected communities • Results and lessons learned from completed or ongoing projects producing similar outputs

2.6 Indicative budget

Activities	Estimated Budget (USD)
Activity 1: Stakeholder consultation, assessment of available data and existing FEWS	70,995
Activity 2: Enhancement of the FEWS	69,200
Activity 3: Capacity building for use of the enhanced FEWS	89,756
Maintenance cost for 2-year period and transfer	18,000
Mandatory audit cost	2,000
Total	**249,951**

Implementation of this Response Plan will be led by the Climate Technology Centre (including selection, contracting, supervision and monitoring of implementation partners) in close coordination with the corresponding National Designated Entity and relevant national actors. Implementation will be led by an International Consortium or Network Partner of CTCN.

2.7 Gender considerations

Floods disasters can affect a large part of households living in major cities of Sudan along the mainstream or tributaries of the Nile. Many of these households will include women and the CTCN assistance will provide improved information on flood disaster management targeting these vulnerable communities through FEWS. The Nile Water Department under the Ministry of Irrigation and Water Resources will ensure that women and men participate equitably in decision-making related to climate technology implementation as well as benefit equitably from technical assistance and project-related training. More specific gender equality will be recognized as an integral part of the

stakeholder engagement and capacity building process, which are part of Output 1 (Activity 1.3) and 3 (Activity 3.2 and 3.3).

2.8 Risk identification and risk mitigation

Risk	Consequence	Probability	Mitigation measure
Inadequate information or data not available for the CTCN assistance	Local validation of the technologies will not be successful.	Less than 10 %	The technology built on existing FEWS from ENTRO and the use of freely available remotely sensed data can support local information, where needed.
Inadequate stakeholder mapping	Required information for the local conditions in Sudan might not be embedded in the technology	Less than 10 %	The Nile Water Department under theMinistry of Irrigation and Water Resources will be responsible for the stakeholder mappingand they have extensive knowledge of the local stakeholders.
Political instability or other forms of unrest	Impact the local presence in the country	Less than 10 %	The situation in Sudan is at the moment stable and it is not foreseen that the country will be affected by any form of unrest within the period of the CTCN support.
Validation of the technologies during flooding events	Technologies not validated within floods caused by infrequent extreme weather events	Less than 25 %	The technologies will initially be validated against previous flooding events using the available historical information. This validation will provide a sound baseline for the validation and testing of the FEWS, in case a validation with recent/currentflood

			events is not possible.

3. Long-term impacts of the assistance

3.1 Expected climate change-related benefits

	CTCN climate technology impact	Anticipated contribution from CTCNassistance
1	Climate technologies adapted to national context are identified and prioritized to enable their deployment and/or transfer in the requesting countries	The Flood Early Warning System (FEWS) setup by the Nile River basin regional entity ENTRO – comprising Egypt, Ethiopia and Sudan – was enhanced so that it is appropriate for Sudanese authorities to increase the resilience of communities in Sudanese national sub-basins.
2	New national Technology Needs Assessment (TNA) and Technology Action Plan (TAP) as a result of the response	
3	Progress made against mitigation objectives (i.e. energy and carbon intensity reduction) as a result of the response	
4	Progress made against adaptation or resilience objectives (e.g. climate vulnerability index improvement) as a result of the response	The technologywill improve the knowledge for future adaptation measures and climate resilient flood management solutions within Sudan.
5	New mitigation or adaptation technology projects/initiatives implemented as a result of the response	The modelling framework is improved for forecasting purposes. This generates the opportunity for building on the result by carrying out very significant field data collection and repurposing the modelling framework for risk assessment purposes of the flood-prone areas.
6	New or strengthened policies/ laws developed, approved and enacted as a result of the response	
7	New policies/laws where climate change was mainstreamed as a result of the response	
8	Country integrating climate change mitigation and/or adaptation issues into its planning and policies as a result of the response	The preparedness and response work of disaster management authorities in Sudan will directly benefit from the enhanced FEWS and the Nile Water Department's increased operational capacity. The data gathered on the flood affected communities will allow national/local authorities to better

		prepare for flood hazards and the enhancements to the early warning facility will allow increased lead time to the agents responsible for response in case of a flood disaster.
9	New or strengthened Public-Private Partnerships (PPP) created directly as a result of the response	
10	New or strengthened twinning arrangement created as a result of the response	
11	Capacities to access and attract public and private finance increase to enable financing of technology deployment	
12	Post-response intervention funding attributable to the response.	
13	Framework and analysis of local production developed to enable deployment of national production of climate technologies	

3.2 Co-benefits

	Sustainable Development Goal	**Contribution from CTCN assistance**
1	End poverty in all its forms everywhere	
2	End hunger, achieve food security and improved nutrition, and promote sustainableagriculture	
3	Ensure healthy lives and promote well-being for all at all ages	
4	Ensure inclusive and equitable quality education and promote life-long learning opportunities for all	
5	Achieve gender equality and empower all women and girls	
6	Ensure availability and sustainable management of water and sanitation for all	
7	Ensure access to affordable, reliable, sustainable, and modern energy for all	
8	Promote sustained, inclusive and sustainable economic growth, full and productiveemployment and decent work for all	
9	Build resilient infrastructure, promote inclusive and sustainable industrialization and fosterinnovation	
10	Reduce inequality within and among countries	
11	Make cities and human settlements inclusive,	

	safe, resilient and sustainable	
12	Ensure sustainable consumption and production patterns	
13	Take urgent action to combat climate change and its impacts	13.1 - Strengthen resilience and adaptive capacity to climate-related hazards and natural disasters in all countries This TA will contribute to enhancing climate resilience in the Setit/Atbara, Dinder andRahad basins by providing innovative methods to generate early warning to the communities. 13.2 - Integrate climate change measures into national policies, strategies and planning The operational flood forecasting capability of the Nile Water Department will contribute to the improved planning by authorities of preparedness and response activities. 13.3 - Improve education, awareness-raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction and early warning This TA will provide a technical manual (or guideline) and a capacity building program to train central/local government officials and relevant stakeholders for effective operation and maintenance of the FEWS and use of its products.
14	Conserve and sustainably use the oceans, seas and marine resources for sustainable development	
15	Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss	
16	Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels	
17	Strengthen the means of implementation and	

	revitalize the global partnership for sustainable development	

3.3. Post-assistance plans and actions

Post assistance plans include actions that may support and increase the ownership of the outcomes, the scaling up of the FEWS hosted by ENTRO and its deployment in Sudan. Some of the immediate actions might include:

- The outcome of the CTCN assistance will be an important step towards fulfilling some of the specified goals in the TNA and NCCAS and the outcomes will be used actively in this process, ensuring a local ownership of the technologies.
- The Nile Water Department will actively facilitate that the outcomes of the CTCN assistance is embedded in future projects to address flood and climate change related issues
- CTCN assistance will ensure that activities (Output 4) will be dedicated to strengthening the technological and technical capacity of the MoIWRnational staffto maximize benefits for the country's disaster management framework.

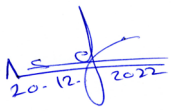
3.4 Monitoring and Reportingof technical assistance results and impacts

Performance indicators of CTCN Assistance				
Response output *(linking to sec 1.2)*	**How output will be used to ensure creation of result**	**Expected result**	**Expected outcome of result** *(linking to sec 1.1)*	**Anticipated impact that outcome will produce** *(linking to section 3)*
Assess the existing Flood Early Warning System of ENTRO available to Sudan, current protocols/procedures and institutional framework.	The assessment will help establish understanding of the current system capabilities and to increase understanding as to what extent the FEWS is able respond to the current country needs and where are the most pressing gaps. The findings will also incorporate stakeholder feedback on what aspects of the current system need upgrading to be able to perform adequately and provide best possible decision support to respond to climate hazards.	**Output 1. Assessment of the existing FEWS system protocols and data identifying existing gaps and needs.**	Stakeholder mapping and data collection. Design of the enhancements required in terms of technology and capacity, so that the FEWS is appropriate, and the staff skills required for its operation are met.	The technology will improve the knowledge for future adaptation measures and climate resilient flood management solutions within Sudan.
Expand and enhance the components of the existing Flood Early Warning System of ENTRO available to Sudan, based on readily available data for increased coverage, efficiency and lead time in the Setit/Atbara, Dinder and Rahad national sub-basins	The upgraded system will enable uptake of the latest technologies and data and will also support expansion of the system coverage to include additional sub-basins currently not covered by FEWS. In this way, the enhanced FEWS will improve the capability of the decision makers and relevant national institutions to effectively and timely use the system for better flood early warning and response.	**Output 2. Enhanced FEWS**.	The Nile Water Department of Sudan will have the tools needed for effective dissemination of flood warnings for the national sub basins Dinder and Rahad as well as the Setit/Atbara.	The Flood Early Warning System (FEWS) enhanced so that it is appropriate for Sudanese authorities to increase the resilience of communities in Sudanese national sub-basins. The modelling framework is improved for forecasting purposes. This generates the opportunity for building on this output by carrying out very significant field data collection and repurposing the modelling framework for risk

				assessment purposes of the flood-prone areas.
Train system operators and build the capacity of a wider net of national FEWS product end users to maximize benefits for the country's disaster management framework **The system will be hosted at DHI's servers for a period of 2 years.**	By strengthening the capacity for system use and maintenance, the output will contribute to long-term sustainability of the system, enabling more effective long-term and strategic use of the relevant technologies.	**Output 3. Strengthened capacity and sustainability for uptake and effective use of the upgraded FEWS.**	The designated Nile Water Department staff operate and maintain the FEWS. The wider net of stakeholders understands the outputs of the FEWS. The Ministry will gain time to buy and install their own hardware, so that the system can be transferred to their premises.	The preparedness and response work of disaster management authorities in Sudan will directly benefit from the enhanced FEWS and the Nile Water Department's increased operational capacity. The data gathered on the flood affected communities will allow national/local authorities to better prepare for flood hazards and the enhancements to the early warning facility will allow increased lead time to the agents responsible for response in case of a flood disaster.

4. Signatures

Signatures of the requesting country

NDE	**Request Proponent**
Name: Huyam Ahmed Abdalla Ahmed Title: Environmental Officer Date: 20 December 2022	Name:AbdelrahmanSaghayroon Elzein Title:**DG**, Nile Water Affairs, MoIWR Date: 20 December 2022
Signature: 	Signature: 

Signatures of the CTCN

CTCN Director	**Climate Technology Manager**
Name: Rose Mwebaza Title: Director CTCN Date: 21 Dec 2022	Name: Title: Date:
Signature:  As OIC for Rose Mwebaza	Signature:

Annex 1:Response Logframe

Activity *(link to sec 2)*	**Description of sub-activities conducted by the CTCN**	**Output/ Deliverable** *(link to sec 2.9)*	**Expected Outcome** *(link to sec 3)*	**Main national partners involved**	**Objectively Verifiable Indicator** *(see Annex 5 guidance)*	**Means of Verification** (data source, method of collection, responsibility and periodicity)
Activity 1 – Stakeholder consultation, assessment of available data and existing FEWS	Activity 1.1 – Kick-off meeting and stakeholder mapping Activity 1.2 – Data collection and stakeholder consultation Activity 1.3 – Inception workshop Activity 1.4 – Review of the collected data Activity 1.5 – Model and FEWS review Activity 1.6 – Capacity needs assessment	Inception Workshop Inception Report Technical assistance management documentation Enhanced FEWS design report Capacity needs assessment report	Stakeholder mapping and data collection Design of the enhancements required in terms of technology and capacity, so that the FEWS is appropriate, and the staff skills required for its operation are met	Nile Water Department Higher Council for Environment and Natural Resources DMH ENTRO National Council for Civil Defense International Development and Aid Organizations NGOs	Number of participants ormeeting days Number of female participants Feedback or recommendations from regional organizations Planning/Outputs distributed to decision makers with feedbacks	Inception workshop Inception Report Enhanced FEWS design report Capacity needs assessment report
Activity2 – Enhancement of the FEWS	Activity 2.1 – Expansion and improvement of the FEWS components Activity 2.2 – Review and improvement of the overall performance of the system Activity 2.3 – Technical manual update	Model calibration and validation report Enhanced FEWS operationalized Updated technical manual	The modelling framework is improved for forecasting purposes. The FEWS has a dissemination component that allows Sudanese authorities to increase the resilience of communities in	Nile Water Department DMH ENTRO	Outputs available and adapted to local context and national priorities; Integration of outputs/outcomes into planning of host country;	Enhanced FEWS operationalized Updated technical manual

			Sudanese national sub-basins.			
Activity3 – Capacity building for use of the enhanced FEWS	Activity 3.1 – Production of training materials Activity 3.2 – Training of government bodies and stakeholders for use of the system Activity 3.3 – Stakeholder workshop for FEWS product end users Activity 3.4 – Preparation of a closure report	Training materials Online and in person training sessions FEWS product end user workshops Capacity enhancement report Technical assistance management documentation	The preparedness and response work of disaster management authorities in Sudan will directly benefit from the enhanced FEWS and the Nile Water Department's increased operational capacity. The data gathered on the flood affected communities will allow national/local authorities to better prepare for flood hazards and the enhancements to the early warning facility will allow increased lead time to the agents responsible for response in case of a flood disaster.	Nile Water Department Higher Council for Environment and Natural Resources DMH ENTRO National Council for Civil Defense International Development and Aid Organizations NGOs	Number of participants trained or training days received Number of female participants Post training evaluation and feedback Feedback or recommendations from regional organizations Planning/Outputs distributed to decision makers with feedbacks	Capacity enhancement report

Annex 2:Response Budget

Activity	Notes	Quantity	Unit	Unit Cost ($)	Total Cost ($)
Activity 1: Stakeholder consultation, assessment of available data and existing FEWS					
Activity 1.1: Project initiation and kick-off meeting					
Personnel					
Expert 1	*Project Manager and Hydrologist*	*3*	*Person day*	*1,263*	*3,790*
Expert 2	*Flood Modelling Expert*	*1*	*Person day*	*1,263*	*1,263*
Expert 3	*Flood Forecasting and Operational Systems Expert*	*1*	*Person day*	*1,304*	*1,304*
Expert 4	*Gender Expert*	*0*	*Person day*	*380*	-
Component sub-total					***6,358***
Sub-total activity 1.1					***6,358***
Activity 1.2: Data collection and stakeholder consultations					
Personnel					
Expert 1	*Project Manager and Hydrologist*	*3*	*Person day*	*1,263*	*3,790*
Expert 2	*Flood Modelling Expert*	*2*	*Person day*	*1,263*	*2,527*
Expert 3	*Flood Forecasting and Operational Systems Expert*	*2*	*Person day*	*1,304*	*2,608*
Expert 4	*Gender Expert*	*0*	*Person day*	*380*	-
Component sub-total					***8,925***
Sub-total activity 1.2					***8,925***
Activity 1.3: Inception workshop					
Personnel					
Expert 1	*Project Manager and Hydrologist*	*6*	*Person day*	*1,263*	*7,581*
Expert 2	*Flood Modelling Expert*	*0*	*Person day*	*1,263*	-
Expert 3	*Flood Forecasting and Operational Systems Expert*	*0*	*Person day*	*1,304*	-
Expert 4	*Gender Expert*	*4*	*Person day*	*380*	*1,520*
Component sub-total					***9,101***
Travel					
Ticket for Expert 1	*Round trip ticket from Copenhagen to Khartoum*	*1*	*Ticket*	*1,350*	*1,350*
DSA for Expert 1	*DSA Khartoum*	*6*	*DSA*	*165*	*990*
Ticket for Expert 4	*Local travel*	*1*	*Ticket*	*400*	*400*
DSA for Expert 4	*DSA Khartoum*	*2*	*DSA*	*165*	*330*
Ticket for national stakeholders	*Local travel*	*25*	*Ticket*	*400*	*10,000*

DSA for national stakeholders	*DSA Khartoum*	*25*	*Day*	*165*	*4,125*
Workshop	*Rental meeting room and catering*	*1*	*Day*	*150*	*150*
Workshop	*Lunches and coffee breaks*	*1*	*Day*	*150*	*150*
Component sub-total					***17,495***
Sub-total activity 1.3					***26,596***
Activity 1.4: Review of the collected data					
Personnel					
Expert 1	*Project Manager and Hydrologist*	*2*	*Person day*	*1,263*	*2,527*
Expert 2	*Flood Modelling Expert*	*2*	*Person day*	*1,263*	*2,527*
Expert 3	*Flood Forecasting and Operational Systems Expert*	*2*	*Person day*	*1,304*	*2,608*
Expert 4	*Gender Expert*	*0*	*Person day*	*380*	*-*
Component sub-total					***7,662***
Sub-total activity 1.4					***7,662***
Activity 1.5: Model and FEWS review					
Personnel					
Expert 1	*Project Manager and Hydrologist*	*1*	*Person day*	*1,263*	*1,263*
Expert 2	*Flood Modelling Expert*	*4*	*Person day*	*1,263*	*5,054*
Expert 3	*Flood Forecasting and Operational Systems Expert*	*4*	*Person day*	*1,304*	*5,216*
Expert 4	*Gender Expert*	*0*	*Person day*	*380*	*-*
Component sub-total					***11,533***
Sub-total activity 1.5					***11,533***
Activity 1.6: Capacity needs assessment					
Personnel					
Expert 1	*Project Manager and Hydrologist*	*6*	*Person day*	*1,263*	*7,581*
Expert 2	*Flood Modelling Expert*	*0*	*Person day*	*1,263*	*-*
Expert 3	*Flood Forecasting and Operational Systems Expert*	*0*	*Person day*	*1,304*	*-*
Expert 4	*Gender Expert*	*0*	*Person day*	*380*	*-*
Component sub-total					***7,581***
Travel					
Ticket for Expert 1	*Round trip ticket from Copenhagen to Khartoum*	*1*	*Ticket*	*1350*	*1350*
DSA for Expert 1	*DSA Khartoum*	*6*	*DSA*	*165*	*990*
Component sub-total					***2,340***
Sub-total activity 1.6					***9,921***

Sub-total activity 1					***70,995***
Activity 2: Enhancement of the FEWS					
Activity 2.1: Expansion and improvement of the FEWScomponents					
Personnel					
Expert 1	*Project Manager and Hydrologist*	*0*	*Person day*	*1,263*	*-*
Expert 2	*Flood Modelling Expert*	*10*	*Person day*	*1,263*	*12,635*
Expert 3	*Flood Forecasting and Operational Systems Expert*	*10*	*Person day*	*1,304*	*13,040*
Expert 4	*Gender Expert*	*0*	*Person day*	*380*	*-*
Component sub-total					***25,675***
Sub-total activity 2.1					***25,675***
Activity 2.2: Review and improvement of the overall performance of the system					
Personnel					
Expert 1	*Project Manager and Hydrologist*	*4*	*Person day*	*1,263*	*5,054*
Expert 2	*Flood Modelling Expert*	*12*	*Person day*	*1,263*	*15,162*
Expert 3	*Flood Forecasting and Operational Systems Expert*	*12*	*Person day*	*1,304*	*15,648*
Expert 4	*Gender Expert*	*0*	*Person day*	*380*	*-*
Component sub-total					***35,863***
Sub-total activity 2.2					***35,863***
Activity 2.3: Technical manual update					
Personnel					
Expert 1	*Project Manager and Hydrologist*	*2*	*Person day*	*1,263*	*2,527*
Expert 2	*Flood Modelling Expert*	*2*	*Person day*	*1,263*	*2,527*
Expert 3	*Flood Forecasting and Operational Systems Expert*	*2*	*Person day*	*1,304*	*2,608*
Expert 4	*Gender Expert*	*0*	*Person day*	*380*	*-*
Component sub-total					***7,662***
Sub-total activity 2.3					***7,662***
Sub-total activity 2					***69,200***
Activity 3: Capacity building for use of the enhanced FEWS					
Activity 3.1: Production of training material					
Personnel					

Expert 1	*Project Manager and Hydrologist*	*4*	*Person day*	*1,263*	*5,054*
Expert 2	*Flood Modelling Expert*	*2*	*Person day*	*1,263*	*2,527*
Expert 3	*Flood Forecasting and Operational Systems Expert*	*2*	*Person day*	*1,304*	*2,608*
Expert 4	*Gender Expert*	*0*	*Person day*	*380*	-
Component sub-total					***10,189***
Sub-total activity 3.1					***10,189***
Activity 3.2: Training of government bodies and stakeholders for use of the system					
Personnel					
Expert 1	*Project Manager and Hydrologist*	*7*	*Person day*	*1,263*	*8,844*
Expert 2	*Flood Modelling Expert*	*7*	*Person day*	*1,263*	*8,844*
Expert 3	*Flood Forecasting and Operational Systems Expert*	*7*	*Person day*	*1,304*	*9,128*
Expert 4	*Gender Expert*	*5*	*Person day*	*380*	*1,900*
Component sub-total					***28,716***
Travel					
Ticket for Expert 1	*Round trip ticket from Copenhagen to Khartoum*	*1*	*Ticket*	*1,350*	*1,350*
DSA for Expert 1	*DSA Khartoum*	*6*	*DSA*	*165*	*990*
Ticket for Expert 2	*Round trip ticket from Copenhagen to Khartoum*	*1*	*Ticket*	*1,350*	*1,350*
DSA for Expert 2	*DSA Khartoum*	*6*	*DSA*	*165*	*990*
Ticket for Expert 3	*Round trip ticket from Copenhagen to Khartoum*	*1*	*Ticket*	*1,350*	*1,350*
DSA for Expert 3	*DSA Khartoum*	*6*	*DSA*	*165*	*990*
Ticket for Expert 4	*Local travel*	*1*	*Ticket*	*400*	*400*
DSA for Expert 4	*DSA Khartoum*	*5*	*DSA*	*165*	*825*
Ticket for national stakeholders	*Local travel*	*12*	*Ticket*	*400*	*4,800*
DSA for national stakeholders	*DSA Khartoum*	*60*	*Day*	*165*	*9,900*
Workshop	*Rental meeting room and catering*	*5*	*Day*	*150*	*750*
Workshop	*Lunches and coffee breaks*	*5*	*Day*	*150*	*750*
Component sub-total					***24,445***
Sub-total activity 3.2					***53,161***
Activity 3.3: Stakeholder workshop for FEWS product end users					
Personnel					
Expert 1	*Project Manager and Hydrologist*	*7*	*Person day*	*1,263*	*8,844*

Expert 2	*Flood Modelling Expert*	*0*	*Person day*	*1,263*	*-*
Expert 3	*Flood Forecasting and Operational Systems Expert*	*0*	*Person day*	*1,304*	*-*
Expert 4	*Gender Expert*	*0*	*Person day*	*380*	*-*
Component sub-total					***8,844***
Travel					
Ticket for Expert 1	*Round trip ticket from Copenhagen to Khartoum*	*1*	*Ticket*	*1,350*	*1,350*
DSA for Expert 1	*DSA Khartoum*	*7*	*DSA*	*165*	*1.155*
Ticket for national stakeholders	*Local travel*	*25*	*Ticket*	*400*	*10,000*
DSA for national stakeholders	*DSA Khartoum*	*25*	*Day*	*165*	*4,125*
Workshop	*Rental meeting room and catering*	*1*	*Day*	*150*	*150*
Workshop	*Lunches and coffee breaks*	*1*	*Day*	*150*	*150*
Component sub-total					***16,930***
Sub-total activity 3.3					***25,774***
Activity 3.4: Preparation of a project closure report					
Personnel					
Expert 1	*Project Manager and Hydrologist*	*0.5*	*Person day*	*1,263*	*632*
Expert 2	*Flood Modelling Expert*	*0*	*Person day*	*1,263*	*-*
Expert 3	*Flood Forecasting and Operational Systems Expert*	*0*	*Person day*	*1,304*	*-*
Expert 4	*Gender Expert*	*0*	*Person day*	*380*	*-*
Component sub-total					***632***
Sub-total activity 3.4					***632***
Sub-total activity 3					***89,756***

Sub-total	**229,951**
Maintenance cost for 2-year period and transfer	**18,000**
Mandatory audit cost	**2,000**
TOTAL BUDGET	***249,951***

Annex 3: Terms of Reference for assistance provider

If needed, in case of subsequent tendering process

Annex 5: Indicative list of performance indicators

Overall Activity	Specific Activity	Indicator
Capacity Building	▪ development and delivery of workshops ▪ development and delivery of trainings (e.g. webinars, e-learning, ad-hoc) ▪ development and delivery of toolkits	Number of participants trained or training days received; Post training evaluation and feedback (and minutes); CTCN Knowledge Management System (KMS) users; Webinar content/minutes/feedback; e-learning content/feedback
Advisory	▪ development of needs assessment/ studies/ reports/ etc. ▪ establishment/development of recommendations	Diversity of sources used; Response Implementer efforts days; Recommendations; Scope of dissemination; Level of detail used; Feedback; Uptake of recommendations
Policy development	▪ development of strategy ▪ drafting of implementation plan ▪ formulation inputs to policy/ law	Strategy available and adapted to local context and national priorities; Number of interview/events conducted to developed the strategy/ plan; Strategy/Plan dissemination; Number of technologies recommended in the strategy/plan; Scope of changes recommended by the strategy/plan.
Project implementation	Mitigation ▪ Energy supply ▪ Energy use ▪ Industry ▪ Transport ▪ Agriculture ▪ Waste management ▪ Forestry Adaptation ▪ Water ▪ Infrastructure, transport and urban design ▪ Early warning and environmental assessment ▪ Coastal zones ▪ Agriculture and forestry	Outputs available and adapted to local context and national priorities; Level of private sector participation; Planning/Outputs distributed to decision makers with feedbacks; Integration of outputs/outcomes into planning of host country; implementation of outputs/outcomes by host country or other multi/bi-lateral organisation; Level of cooperation between Response Implementer, NDE and Response Proponent(s).

Overall Activity	**Specific Activity**	**Indicator**
	▪ Human health ▪ Marine and fisheries	
Development of a new partnership or strengthening of an existing one	▪ Development/ Establishment of basis for Twinning ▪ Development/ Establishment of basis for PPP ▪ Development/ Establishment of basis for knowledge partnership	